WHAT IS CLAIMED IS:

1. A method for screening an array of materials for mechanical properties, comprising:

providing a library of at least four different material samples secured on a substrate;

directing a force from at least one fluid to each of said samples while said samples remain on said substrate, for applying pressure to each of said samples and causing each of said samples to displace in response to said pressure; and

monitoring a response of each of said samples to said pressure with at least one response sensing device.

2. The method of Claim 1, wherein the method is capable of screening at least two of said samples of said library simultaneously.

3. The method of Claim 1, wherein the method is capable screening at least twenty-four of said samples of said library simultaneously.

4. The method of Claim 1, wherein screening throughput rate of said library is no greater than about ten minutes.

5. The method of Claim 1, wherein said pressure is applied to each of said samples in sequential order and screening throughput rate is no greater than 10 minutes per said sample.

6. The method of Claim 1, wherein said mechanical properties are selected from a group consisting of flexure, uniaxial extension, biaxial compression, shear, stress and strain at failure, toughness, storage modulus,

loss modulus, and mixtures thereof.

7. The method of Claim 1, further comprising of regulating environmental conditions of said samples.

8. The method of Claim 1, wherein said at least one response sensing device selected from a group consisting of an electronic pressure sensor, an optical response sensing device selected from a group consisting of optical reflectance, optical interferometry, shadow illumination, and a combination thereof, an electrical response sensing device selected from a group consisting of capacitance, resistance, tunneling, electromechanical switching, and a combination thereof, a dual pressure sensing device, and a combination thereof.

9. The method of Claim 1, wherein said samples are secured on said substrates by means selected from a group consisting of mechanically, magnetically, electromagnetically, electromechanically, chemically, and a combination thereof.

10. The method of Claim 1, wherein said directing a force to said fluid is conducted by a force source selected from a group consisting of a piston in a cylinder, a temperature controller for varying the temperature of said fluid, a heat transfer device selected from the group consisting of a resistance heater, a liquid-liquid heat exchanger that is connected to a reservoir of exchange fluid, a liquid-gas heat exchanger that is connected to a reservoir of exchange fluid and a combination thereof, and a combination thereof.

11. The method of Claim 1, wherein said fluid is chemically inert to said library of material samples, allows said pressure applied to said samples to be controlled and variable, and is selected from a group consisting of air, argon,

hydrogen, nitrogen, helium, fluorocarbon liquids, ethanol, water, mercury and mixtures thereof.

12. The method of Claim 1, wherein two of said fluids are both used to apply pressure to one of said samples, said two fluids are mutually immiscible and separation between said two fluids is maintained by means selected from a group consisting of gravity, surface tension, and a mixture thereof.

13. The method of Claim 1, wherein said pressure applied to each of said samples is a negative pressure.

14. The method of Claim 1, wherein each of said samples is has an area of less than about 100 mm^2.

15. The method of Claim 1, wherein each of said sample has a thickness of less than about 500 microns.

16. The method of Claim 1, wherein said pressure applied to each of said samples is selected from a group consisting of monotonic, sinusoidal, discontinuous, and a combination thereof.

17. A method for screening an array of materials for mechanical properties, comprising:

providing a flexible substrate;

depositing a library of at least four different material samples onto said substrate;

measuring the thickness of each of said samples;

securing said substrate onto a mounting member with a plurality of openings to which said samples on said substrate are removeably secured across said openings;

compressing at least one transmission fluid against said substrate causing pressure to be applied to each of said samples;

monitoring a response of each of said samples to said compression with at least one response sensing device selected from a group consisting of an electronic pressure sensor, an optical response sensing device, an electrical response sensing device, a dual pressure sensing device, and a combination thereof; and

ranking said samples relative to each other according to their respective performance.

18. The method of Claim 16, wherein the method is capable of screening at least two of said samples of said library simultaneously.

19. The method of Claim 16, wherein screening throughput rate of said library is no greater than about ten minutes.

20. The method of Claim 16, wherein said pressure is applied to each of said samples in sequential order and screening throughput rate is no greater than 10 minutes per said sample.

21. The method of Claim 16, wherein said mechanical properties are selected from a group consisting of flexure, uniaxial extension, biaxial compression, shear, stress and strain at failure, toughness, Young's modulus, complex modulus, and mixtures said thereof.

22. The method of Claim 16, further comprising of regulating

environmental conditions of said samples.

23. The method of Claim 16, wherein said samples are secured on said substrates by means selected from a group consisting of mechanically, magnetically, electromagnetically, electromechanically, chemically, and a combination thereof.

24. The method of Claim 16, wherein said compression is conducted by a force source selected from a group consisting of a piston in a cylinder, a temperature controller for varying the temperature of said transmission fluid, a heat transfer device selected from the group consisting of a resistance heater, a liquid-liquid heat exchanger that is connected to a reservoir of exchange fluid, a liquid-gas heat exchanger that is connected to a reservoir of exchange fluid and a combination thereof, and a combination thereof.

25. The method of Claim 16, wherein said transmission fluid is chemically inert to said samples, allows said compression to be controlled and variable, and is selected from a group consisting of air, argon, hydrogen, nitrogen, helium, fluorocarbon liquids, ethanol, water, mercury and a mixtures thereof.

26. The method of Claim 16, wherein two of said transmission fluids are both used to apply pressure to one of said samples, said two transmission fluids are mutually immiscible and separation between said two transmission fluids is maintained by means selected from a group consisting of gravity, surface tension, and a mixture thereof.

27. The method of Claim 16, wherein each of said samples has an area of less than about 100 mm^2.

28. The method of Claim 16, wherein each of said sample has a thickness of less than about 500 microns.

29. A method for screening an array of materials for mechanical properties, comprising:

providing a mounting member having a plurality of openings, wherein said mounting member is adapted for connection to a source of a fluid pressure;

placing a flexible substrate having a library of at least two different material samples deposited thereon onto a surface of said mounting member over said openings for defining a substantially gas tight vessel, wherein each of said samples has an area of less than about 100 mm^2 and a thickness of less than 500 microns;

aligning said samples with said openings;

introducing at least one fluid that is chemically inert to said samples, and is selected from a group consisting of air, argon, hydrogen, nitrogen, helium, fluorocarbon liquids, ethanol, water, mercury and mixtures thereof into said mounting member for applying pressure to each of said samples;

regulating environmental conditions of said samples;

using a source selected from a group consisting of a piston in a cylinder, a temperature controller for varying the temperature of said transmission fluid, a heat transfer device selected from the group consisting of a resistance heater, a liquid-liquid heat exchanger that is connected to a reservoir of exchange fluid, a liquid-gas heat exchanger that is connected to a reservoir of exchange fluid and a combination thereof, and a combination thereof, to deliver a force to said at least one fluid to each of said samples for applying pressure to each of said samples while said samples remain on said substrate and causing each of said samples to displace in response to said pressure; and

monitoring a response of each of said samples to said pressure with at least one response sensing device selected from a group consisting of an

electronic pressure sensor, an optical response sensing device, an electrical response sensing device, a dual pressure sensing device, and a combination thereof, wherein said mechanical properties screened are selected from a group consisting of flexure, uniaxial extension, biaxial compression, shear, stress and strain at failure, toughness, Young's modulus, complex modulus, and mixtures said thereof.

30. The method of Claim 28, wherein the method is capable of screening at least two of said samples of said library simultaneously.

31. The method of Claim 28, wherein screening throughput rate of said library is no greater than about ten minutes.

32. The method of Claim 28, wherein said pressure is applied to each of said samples in sequential order and screening throughput rate is no greater than 10 minutes per said sample.

33. The method of Claim 28, wherein two of said fluids are both used to apply pressure to one of said samples, said two fluids are mutually immiscible and separation between said two fluids is maintained by means selected from a group consisting of gravity, surface tension, and a mixture thereof.